EXPLORATION ON DRIVERS' PERCEPTION TOWARDS TRAFFIC INVENTORY PERFORMANCE

NADIA BINTI ARIB

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ABSTRACT

Managing traffic performance is the practice of councils and highway authorities in controlling the use of road network in order to provide safety and achieve efficiency of traffic flow. Often the reliability of traffic performance is neglected when the development of new road evolves over time. However, the significance of road performance cannot be ignored as it involves the safety of road users that cannot be compromised. Therefore, this study is intended to explore drivers' perception towards traffic inventory performance as well as to suggest basic approach for improving the road. To achieve this, Jalan Kuantan – Gambang was chosen as study location. This study was conducted by using a qualitative study by means of questionnaires distribution. Then the average index method was performed to indicate the driver's perception towards traffic performance. This study may provide a handy reference to the road authorities and can be used in value engineering appraisal if required by interested party.

ABSTRAK

Hal ehwal prestasi trafik adalah urusan majlis – majlis dan pihak berkuasa lebuh raya merangkumi pengawalan penggunaan rangkaian jalan raya demi menjaga keselamatan dan mencapai kecekapan aliran trafik. Kebiasaannya, kebolehpercayaan prestasi trafik tidak lagi diendahkan apabila pembangunan jalan baru berkembang dari masa ke masa. Walau bagaimanapun, kepentingan prestasi jalan raya tidak boleh diabaikan kerana ia melibatkan keselamatan pengguna jalan raya yang tidak boleh dikompromi. Oleh itu, kajian ini bertujuan untuk meninjau persepsi pemandu terhadap prestasi inventori trafik serta mencadangkan pendekatan asas bagi memperbaiki jalan raya. Untuk mencapai matlamat ini, Jalan Kuantan - Gambang telah dipilih sebagai lokasi kajian. Kajian ini dijalankan dengan menggunakan kajian kualitatif melalui pengedaran borang soal selidik. Kemudian, kaedah indeks purata telah dilakukan untuk mengenalpasti persepsi pemandu terhadap prestasi lalu lintas. Kajian ini mungkin dapat dijadikan sebagai bahan rujukan yang berguna kepada pihak berkuasa lebuh raya dan boleh digunakan dalam menilai penilaian kejuruteraan jika dikehendaki oleh mana – mana pihak yang berkepentingan.

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CHAPTER I

INTRODUCTION

1.1 BACKGROUND OF STUDY

Road has become among one of the most important infrastructure equipment worldwide. History of the road construction was already commenced from China and Roman civilization since the birth of figures like Robert Philips, John Metacalf, Thomas Telford and John Macadam (Mimi Das Saikia et al., 2010). Ever since the era, the development of the highway system in Malaysia continues to evolve over time as the roads is one of the important aspects of human relationships primarily involves commercial activities. The need for efficient road networks and safety is very important and for that reasons, today's efforts in improving the ease and safety of road users is growing rapidly.

In Malaysia, roads network and highways are important as it plays the role to connect a destination to another destination. As rapidity of development in Malaysia has contributes to the economic growth, it has indirectly increases vehicle occupancy over the last ten years. Based on Malaysia's transportation statistic, the number of vehicles on the roads increased by about 5 percent per year. Reported in year 2012, a total of 905 931 vehicles registered in the state of Pahang. The number increased from a total of 856 279 in 2011 and 807 808 in 2010 (Ministry of Transport, 2012).

Over the years, industrialization and urbanization with high growth rate has causes several traffic conflicts all over the world. Nowadays, traffic inventory performance is among the important problems worldwide. Like most of the developing country, Malaysia is facing an increase of vehicle occupancy and of accompanying problems with the loading of this traffic volume. Unceasingly, road facilities experience failures more rapidly than expected due to the increases of traffic volume and insufficient degree of maintenance. Therefore, it will be desirable to minimize the conflicts and increases the competence of traffic management in handling road facilities.

In transportation engineering, a traffic conflict is an event involving two or more moving vehicles approaching each other in a traffic flow in such a way that a traffic collision would ensue unless at least one of the vehicles performs an emergency maneuver. According to Dinesh Mohan (2002), road traffic accidents is the leading cause of death by injury and the tenth-leading cause of all deaths globally which now make up a surprisingly significant portion of the worldwide burden of ill-health. Exposure to potential road traffic injury has increased largely because of rapid motorization, coupled with poor road conditions, rapid population growth, lack of safety features in cars, crowded roads, poor road maintenance, and lack of police enforcement (Population Reference Bureau, 2006).

In order to reduce traffic conflicts, effective traffic inventory management should be applied to ensure the traffic flow smoothly, efficiently and functioning accordingly at all acceptable safety level. Traffic inventory is an important transportation consideration because it relates to geometry design, road furniture, network location and environment (Paterson and Scullion, 1990). It is often suggested that old roads are designed without adequate investigation of driver risk perception. Therefore, association of driver's risk perception towards traffic inventory should be taken into account when conducting a relevant study. Although the attitude of road users is hard to be emphasized, however according to many researchers, it is imperative that human factor can be considered during the design of the road infrastructure. The main goal is to have a better traffic flow in any intervention through the assessment of traffic inventory management analysis through risk perception.

Therefore, a relevant study must be conducted for a better understanding in the exploration of traffic inventory performance. The need to investigate the driver's perception towards traffic inventory management system has become necessary in order to for seen traffic needs as to propose traffic management strategy.

1.2 PROBLEM STATEMENT

Accidents are relatively unpredictable. The widely known contributing factor deduce to road accidents involved human factor, vehicle factor, road and environment factor (Road Safety Department Malaysia, 2010). It can happen by a combination of tired drivers and poor road geometry or poor vehicle condition. Accidents due to human occur in many ways including human perception and driving behavior varies with age, emotion, belief and attitude. In addition, the fact that accident can happen due to poor road environment management should not be neglected. Unidentified road environment factors that can activate an accident together with the manageable roadside areas are a hidden factor that seldom been discussed among road safety research. Road environment covers many aspects such as road conditions, roadside conditions, traffic volumes, operational speed and the conditions driving ambience itself. Prior to this issue, this study was conducted to explore on driver's perception towards traffic inventory performance that maybe a potential factor affecting road safety.

1.3 OBJECTIVES

This study is of interest to explore traffic inventory management through the assessment of risk perception before planning effective countermeasures. To achieve the aim of this study, the following objectives have been set:

i. To explore drivers perception towards traffic inventory performance.
ii. To suggest basic approach for improving road performance.

1.4 SCOPE OF STUDY

The scopes of study have been determined in order to ensure that literature study is focusing on certain fields only. The limitations of this study are listed below.

i. The study area is focused on Jalan Kuantan-Gambang because it is the main trunk road connecting Kuala Lumpur and Johor to east coast.
ii. The starting point of study area is from intersection of Jalan Tun Razak until Jalan Tanah Putih in front of Giant Hypermarket excluding central business district.
iii. A questionnaire method is done for the data collection to obtain drivers' perception.
iv. The targeted group is people who are familiar with the road so that the data will not be bias and more focus.
v. The samples are stratified based on age where younger in between 18 to 34, middle age in between 35 to 64 and older is 65or above.
vi. The questionnaire is focused on 4 elements of traffic management; geometry design, road furniture, network location and environment (Paterson and Scullion, 1990).

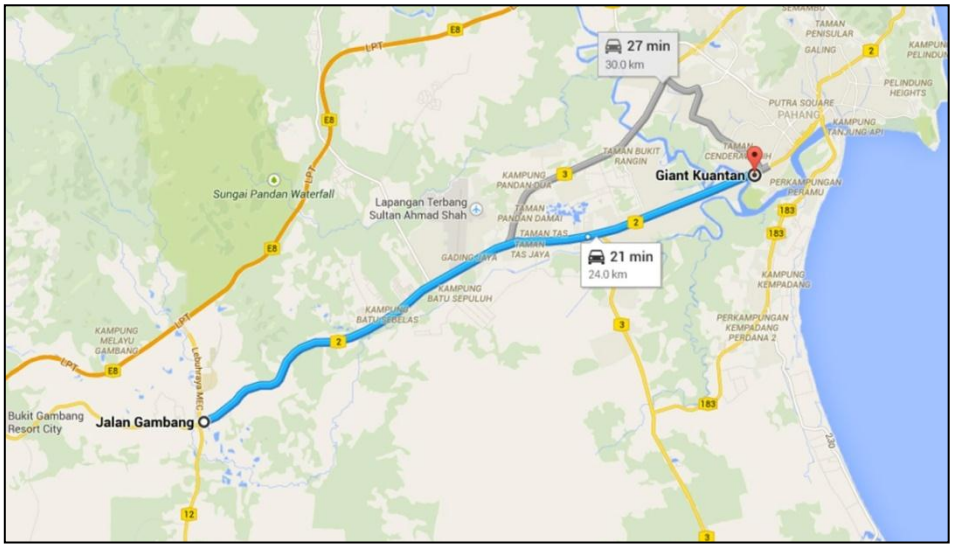

Figure 1.1: Study area of Jalan Kuantan - Gambang

1.5 SIGNIFICANT OF STUDY

Since traffic management involves large amount of data collection and analysis, it is thus intended in this study to gather data for traffic inventory management system which will raise the awareness of local authority regarding the existing road performance and anticipated traffic needs along Jalan Kuantan-Gambang. This survey can be made as a feeder for Road Safety Audit to fill in the gap of justification as they provide a vital role in road checking if it has been designed and built with safety. (Martin Belcher et al., 2008). From this study, we can also propose basic approach for improving traffic inventory performance.

Furthermore, the data gathered in management system studies upon the performance of a traffic stream along the network can be useful for further investigation on traffic management. The most important thing is that it is absolutely practical to be aware of the weakness in traffic inventory management system so that improvement can be made.

CHAPTER II

LITERATURE REVIEW

2.1 INTRODUCTION

The fundamental objective of any intervention or countermeasure in traffic is to provide safety and achieve efficiency of traffic flow. Whenever the management system deficiencies are encountered, it is expected of the PWD's responsibilities to plan implementation strategies if it requires any physical construction. Countermeasures can be implemented soon after a problem is analyzed and a solution is developed. As to meet the demand of road users, the evaluation of the existing road performance is vital to plan methods of improving the transportation system of the region. For this reason, the need to investigate the relationship between driver's perceptions with traffic management has become necessary in order to foreseen traffic needs as to propose traffic management strategy.

2.2 TRAFFIC MANAGEMENT

A highway information system is a system for identifying, collecting, storing, retrieving and managing all data relating to highways which are relevant to the planning, management and operation of a road network (William D. O. Paterson and Thomas Scullion, 1990). It is commonly believed that road management systems are computer programs. This is wrong. Computer software systems are data management and decision support tools used for road management. They are but one part of the overall management

process and, thus, the road management system (HTC Infrastructure Management World Bank, 2000). The management process includes all of the people involved and includes much data collection, analysis, design, and other activities outside the computer software. There may be several software systems which are used in the management process, some of which interact and some of which operate independently. Everything ties together to constitute a road management system.

Management systems therefore serve several functions: they ensure rational and efficient allocations of resources; they maximize the benefits from investments; and, they help ensure that investment objectives and spending priorities are met. These functions can only be achieved by considering the needs of the entire network in the analysis process. This is because the appropriate solution for any one section depends not only on the condition of the section, but also on the needs for the entire network. In addition, it is necessary to consider a wide range of solutions for each section since when operating under budget constraints, which prevail throughout the world, we will usually need to select suboptimal solutions after considering the network needs.

According to Finnish Transport Agency (2010), traffic management measures are aimed at improving the safety and flow of traffic, reducing traffic emissions and utilizing traffic artery capacity more effectively. Traffic management is used to curb demand for transport and affect the selection of the mode of transport, route, or the time of travel or transport. In particular, it is utilized during the first stages of the four-step principle applied in the development of traffic conditions.

Having adequate data is a pre-requisite for effective road management. Although having good data will not guarantee that the correct decisions are made, bad data make sound management difficult (Finnish Transport Agency, 2010). As the figure above shows, a central database is at the heart of the software used for road management. Road management data can be placed into three broad groups:

i. Inventory - These are the physical elements of the road network which do not change markedly over time.
ii. Condition - The elements of the network which change over time and/or under traffic.
iii. Traffic - Data on traffic volumes, composition, load, costs, etc.

Although these groups of data differ quite markedly, there are common principles that need to be considered when establishing a data collection programme. (Christopher R. Bennett et al., 2007)

On the other hand, the familiar tools (which are considered traditional) those are applied as traffic and demand management tools in order to increase the efficiency of the transport system include and not limited to:

i. Prioritization of road users (i.e. introduction of truck lanes, bicycle and pedestrian routes, peak lanes, etc.)
ii. Road hierachisation (i.e. classification of road function)
iii. Road markings and signs, enforcement devices (i.e. camera, police patrol, etc.)
iv. Regulation of parking space, congestion charges, fuel prices, traffic restraints (i.e. limiting entry to city centre, pedestrization of city centre, etc.)
v. Improvement of public transportation, etc.

These tools are relatively cost-effective and technologically affordable and are applicable both in developing and developed countries. However, much as they may seem affordable, yet they are not effectively implemented in most developing countries (Masatu L.M. Chiguma, 2007).

2.3 ROAD INVENTORY

When considering the road infrastructure and its associated data, there are different types of data used for road management. **Table 2.1** shows one data grouping from Paterson and Scullion (1990). This report only focuses on the first element.

Table 2.1: Road Management Data (Paterson and Scullion, 1990).

Element	**Aspects**
Road Inventory	Geometry Furniture/Appurtenances Network/Location Environs
Pavement	Pavement Structures Pavement Condition
Structures	Structures Inventory Bridge Condition
Traffic	Volume Loadings Accidents
Finance	Unit Costs Budget Revenue
Activity	Projects Interventions Commitments
Resources	Institutional Materials Equipment

Public road inventory is a compilation of information about the status and condition of the road system. Necessary to classify and monitor the highways, roads and streets within a state, the transportation data section collects and maintains road information. From the data gathered, reports such as Federal Highway Performance Maintenance System are written and submittal (Oregon TPR, 1991).

In other words, inventory system is a data base, compiled by the Federal Highway Administration, with information on all road structures. The data is often used to analyze road and judge their performance. The traffic inventory is develop with the purpose of having a unified database for road, including identification information, road types and specification, operational conditions, geometric data and functional description, inspection data. Etc.

According to Christopher R. Bennett et al. (2007) inventory data are the physical elements of the road system. These do not change markedly over time. Road inventory data are typically collected in a once-off exercise and require updating when changes are made to the road, such as new roads or realignment. It is common to verify or update the data every five years or so.

It is known that road inventory should be viewed as an important national asset and must be regularly maintained to keep them serviceable like any other assets (Nurul Wahida Mohamed, 2010). Effective asset performance from the view of traffic management means that council and road authority is capable in controlling the use of road network as to face real costs for the construction of the assets, to make decision making process about repair, rejuvenation or reconstruction of the assets based on economic criteria (Ján Mikolaj, Mária Trojanová, Ubomír Pepucha, 2012). Public Work Department has been procured to capture and update the inventory and condition of traffic facilities asset on federal road networks throughout the state which includes but not limited to the following traffic asset (Technical Direction, 2003):

i. Signs, eg. Regulatory, Warning and Guide Signs
ii. Longitudinal Line marking, eg. Lane lines, Edge lines and Centerlines
iii. Transverse Lines, eg. Stop/Give Way lines. Pedestrian crosswalk lines, etc
iv. Other Markings, eg. Speed Numerals, Arrows, Chevrons, etc
v. Pavement Markers, eg. RPMs and RRPMs
vi. Safety Barriers, eg. Guard Rail, Wire Rope, Mesh Fencing, etc
vii. Guide Posts
viii. Traffic Signals (locations and associated signs & markings only)
ix. Other Assets, eg. Roadside Rest Areas, Street lights, etc

From the view of road users, road asset must be well maintained by the authority as to provide safety and comfort. According to Ahmad (2002) maintenance is always a must for any structure in order to maintain its serviceability and to prevent deterioration that may shorten the service life. In reality, maintenance works are not given the attention it should have as the inventory management system can be seen as poorly managed. Therefore, it is a fact that effective management is the most important since the allocation of maintenance need to be carried out to prolong or at least maintain serviceability of structure until the end of its service life without prior consideration of budget. It is fundamental to be aware of the objective of any intervention or countermeasure in traffic is to provide safety and reduce fatalities.

2.4 ROAD SAFETY

Traffic accidents rank fifth among the leading cause of deaths in Malaysia (Department of Statistic, 2008). Accidents are relatively rare and unpredictable, sometimes it is direct observation and often impossible. However, the number of traffic accidents in Malaysia continues to raise despite implementation of various intervention measures over the years. It is quite difficult to control accidents since there are too many factors that influence the accidents to happen. Such factors are weather conditions, road conditions, right-of way constraints, and the drivers' behavior themselves. This could also be due to

growth in urbanization and in the number of vehicles which exceeds the designed volume that they are able to carry.

Research by the Malaysian Institute of Road Safety (Miros) showed that averages of 18 people were killed on Malaysian roads daily. Therefore, roadside safety must be improved and an appropriate action must be taken very seriously. Since the country's independence, a number of bodies concerned with road safety have been formed within government departments, private sector agencies and voluntary organizations. Road traffic safety has been considered as one of the social responsibilities to be taken care of by the Malaysian Government. The concern for road safety was to reduce or minimize the effects from vehicle accidents such as death, injuries, and property damage.

Till 80s more focus was in developing road length by constructing new roads and very low consideration was given for maintenance and road safety. Road construction followed standard geometrics with least concern for road safety. Most of the roads and bridges did not have walkways and other required road safety features. The road intersections, blind curves, and bridge approaches were the most vulnerable spots for the motorists, as well as the pedestrian.

Considering the importance of road asset preservation and to reduce the road users cost, rehabilitation and maintenance program were implemented in the strategic roads. Improved road condition induced sudden increase in vehicle fleet and speed, resulting increase in road accidents and casualties.

It is difficult to be accurate about the number of road accident as many accidents, including ones where people are injured, are not reported to the Police. Only those accidents with high injury or property damage or with disputes are reported and recorded in the police office.

2.5 ROAD SAFETY AUDIT

Road safety is now recognized as a major socioeconomic concern facing the gulf region (Municipality of Abu Dhabi City, 2010). Increasing traffic volumes, the rapid growth in traffic and the higher speeds made possible by construction improvement and rehabilitation of roads can all add to the safety problem. Problems can sometimes arise when insufficient attention is given to road safety impacts. For example, higher speeds that become possible on improved roads can lead to an increase in road safety risk for communities along such route and for vulnerable road users. This, in turn, can lead to an increase in the number of deaths and casualties on such roads.

The concept of Road Safety Auditing is becoming more widespread and the number of countries adopting Road Safety Audit Procedures and practices is increasing worldwide. Experiences around the world have demonstrated that it is possible to substantially reduce potential safety problems by implementing systematic safety checks which enable potential hazards to be identified and eliminated. The road safety auditing alone cannot solve all the safety concerns but can play an important part in preventing the circumstances that can lead to road accidents.

Road Safety Audit is a systematic process for checking the safety of new schemes on road. It should be based on sound safety principles and should ensure that all highways schemes operate as safely as is practicable by minimizing future accident numbers and severity (Martin Belcher at el, 2008). Road Safety Audit is not an opportunity to redesign a scheme or to make changes to design with no apparent link to safety issue. It is not intended to be a technical check on the design elements nor a design standard check. These should be carried out independently of the Road Safety Audit. Although Road Safety Audit does look at scheme design from the road user's point of view, it is not in fact a 'road user audit'.

A Road Safety Audit (RSA) is a very effective tool to reduce injuries and fatalities on the roads. It is a formal safety performance examination of an existing or future road or intersection by an independent and multi-disciplinary team. It estimates and reports on potential road safety issues and identifies opportunities for improvements in safety for all road users (Municipality of Abu Dhabi City, 2010).

The primary purposes of carrying out safety audit is to ensure that any changes carried out on the highway do not include features, or combination of features, that may have a contributory influence on future injury collision. Road Safety Audits are generally carried out at up to five stages of a new road project: feasibility study, draft design, detailed design, pre-opening and a few months after opening. They should be done by experienced teams that are independent from the project teams (Allsop R., 1997). A key part of a compressive road safety plan must be the safe design of our road infrastructure. Road Safety Audit provides a vital role in checking that road have indeed been designed and built to the highest safety standard (Martin Belcher at el, 2008).

Most countries do not carry out such audits, but those that do, such as Malaysia, can provide guidelines. Together with area-wide safety impact assessments before proposals for projects are improved, safety audits can help to optimize the safety of the whole road network. Even where area-wide impact assessment and road safety audits are carried out, experience may show that certain sites, sections or areas are hazardous and need improvement. Possibilities include: adding skid-resistant surfaces, improving lighting, providing central refuges or islands for pedestrians, adding signs or markings, improving junctions with signals or roundabouts and adding pedestrian bridges. Safety defects may also arise through poor maintenance: for example, road surfaces and signs are deteriorated and roadside lights do not function. Nevertheless, the improvements needed to make an entire road network or a hazardous site safer often cost little but can result in huge benefits in terms of reduced incidence of road crash and injury (Margie Peden et al, 2004).

For many years Road Safety Audit has made a significant contribution to improving highway safety. The formal audit process involves looking at schemes throughout the various stages of design, planning and construction, and trying to identify road safety problems. The auditor then goes on to recommend solutions to the problems that have been described. One of the benefits of RSA is that the auditor can suggest measures that mitigate against the constrains imposed upon the design.

Road Safety Audit (RSA) provides road safety engineers with an opportunity to feed their experience into the highway design process. RSA should improve the awareness of safe design practices by all concerned in the design, construction and maintenance. This makes it more like that the road will operate safely in the environment in which it has to operate.

2.6 GEOMETRY DESIGN

The highway engineer must design for a wide range of vehicle operating characteristics and allow for great differences in driver and pedestrian characteristics. Most highway facilities must be designed to accommodate the smallest automobile as well as the largest tractor-trailer truck. A well-designed highway facility provides consistent information to the road user, assures a safe facility for the most vulnerable user of the system, and conforms to context-sensitive placement issues.

The design of highways necessitates the determination of specific design elements, which include the number of lanes, lane width, median type and width, length of acceleration and deceleration lanes for on- and off-ramps, need for truck climbing lanes for steep grades, curve radii required for vehicle turning, and the alignment required to provide adequate stopping and passing sight distances. When one considers the diversity of vehicles' performances and physical dimensions, and the interaction of these characteristics with the many elements constituting highway design, it is clear that proper design is a complex procedure that requires numerous compromises (Fred L. Mannering et al, 2005).

Geometric design practices of the state highway and other designing agencies are not entirely uniform on a national basis. A considerable variation exists in the laws of the various states, which serve to limit the size and weight of motor vehicles. Differences in local condition among regional factors such as terrain, weather condition and available construction materials affect standards and design practices on a state-by-state basis (Paul H. Wright and Karen Dixon, 2004).

For a given class of highway, the choice of design speed is governed primarily by the surrounding topography, regional importance within the larger highway network, magnitude of related construction impacts and capital costs associated with construction of the highway project. Once a design speed is chosen, many of the elements of design (e.g., horizontal and vertical alignment, shoulder width and side slope) may be established on the basis of fundamental human sensory capabilities, vehicle performance and other related operating characteristics (Paul H. Wright and Karen Dixon, 2004).

In a situation where the volume of traffic is light or in a free flowing condition, driver's selection of speed is usually constrained by such factors as the road geometry features, lighting, and weather conditions.

Yagar and Vanar (1983) list the factors affecting capacity and speed-flow relationships for two-lane highways under three headings, as follows;

i. Geometric factors: grades, bendiness, lane width, lateral clearance
ii. Traffic factors: vehicle mix, abutting land use (not really a traffic factor), turning movements
iii. Weather-surface factors: darkness, pavement roughness and the winter season alone (without adverse weather) all decreased speed.

The dimensions of the motor vehicles that will utilize the proposed facility also influence the design of a roadway project (Paul H. Wright and Karen Dixon, 2004). The width of the vehicle naturally affects influence the width of the traffic lane; the vehicle